



National Transportation Safety Board
Washington, D.C. 20594

Safety Recommendation

Date: February 25, 1997

In reply refer to: P-97-1 through 4

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About 8:30 a.m. on November 21, 1996, an explosion occurred in the Humberto Vidal, Inc., shoe store and office building at 100 Calle José de Diego in Río Piedras, a community in San Juan, Puerto Rico. Local emergency agencies responded and initiated search and rescue operations. The explosion caused 33 fatalities and more than 80 injuries.

The National Transportation Safety Board interviewed numerous citizens and many San Juan Gas Company (SJGC)¹ employees to determine their knowledge about events occurring before, during, or after the explosion. The Safety Board also tested the subsurface in the vicinity of the destroyed and damaged buildings to determine whether it contained combustible materials and to locate any damaged pipelines. Laboratory analyses confirmed the presence of propane, a heavier-than-air gas, in the subsurface at three locations. When the Safety Board excavated pipes at locations where leakage was suspected, it found a damaged and leaking 1¼-inch-diameter polyethylene plastic gas line beneath Calle Camelia Soto and a damaged and leaking 2-inch-diameter steel gas service line beneath Calle Arzuaga; these two streets are, respectively, immediately west and south of the Humberto Vidal building.

Several people in the Humberto Vidal building and adjacent areas stated that they had detected the odor of gas for about a week before the explosion, and some stated that they had reported their observations to the SJGC. Most who reported detecting the odor stated that they

¹ The SJGC is owned by Enron Corporation (Enron). At the time of the explosion, the SJGC's operations were overseen through two Enron subsidiaries: Enron Americas, Inc., and Enron Operations Corporation. Enron recently underwent a reorganization, and the SJGC now is overseen by Enron Ventures Corporation.

did not notify local emergency agencies or evacuate any buildings because they did not realize that the odor represented a potential danger to themselves or to others and because they thought that after they had reported the odor, the SJGC would resolve the matter. SJGC records show only two notifications: one on November 14 and the other on November 20.²

According to SJGC records, the manager of the shoe store called the SJGC at 8:15 a.m. on November 14 to report an odor of gas in the building.³ The SJGC employee who took the call acknowledged that the manager reported detecting the odor in the building basement; however, SJGC recorded his complaint as a report of a gas leak in the street. An SJGC employee stated that he arrived at the shoe store about 9:00 a.m., met with the manager, and, using a gas detection instrument, checked the basement. He stated that he did not detect any gas. The SJGC sent a gas brigade (work crew) the next day to further explore the reason for the gas odor complaint. The brigade leader stated that holes were made through the pavement (bar holes) on Calle José de Diego near the gas main, which was about 3 feet under the ground. He stated that the brigade made the holes 18 inches deep and used a combustible gas indicator to test them for combustible gas. Tests in two bar holes revealed a level of combustible gas less than 2 percent of the lower explosive limit of propane.

Although witnesses said that they continued to complain about an odor to the SJGC, the company did not record another report until November 20. The company sent another brigade to investigate, and it also made bar holes. The brigade leader stated that bar holes were made over the gas mains to a depth of 18 inches in both Calle José de Diego and Calle Camelia Soto. Testing in the bar holes did not reveal any combustible gas. The brigade leader took his instrument to the SJGC office and tested it to assure himself that it was functioning correctly. He did not find any problems, and the brigade then returned to the bar holes and again tested without detecting the presence of combustible gas.

A third brigade was sent the next morning, November 21. The brigade leader stated that the brigade arrived between 7:30 and 8:00 a.m. According to the leader, the brigade first tested in the bar holes that had been made in Calle José de Diego on November 20. Then, without checking the gas system map that was in the SJGC truck, the brigade made additional bar holes in Calle José de Diego. The new holes, 18 inches deep, were made in the street in front of the west building wall, about 5 1/2 to 6 feet north of and parallel to the south curb line. Although the gas main was only 3 feet north of the south curb line, the brigade leader selected the bar hole locations based on his recollection of the gas main location when he had worked in the same area 2 months earlier. He said that the bar holes made the day before were also about the same distance from the south curb. He did not find any indication of combustible gas in the first bar

² Before the explosion, the SJGC recorded initial leak complaints but did not record subsequent complaints from the same location if the receiver was aware that there had been a previous complaint and that a brigade (work crew) was investigating it. The SJGC now records all leak complaints.

³ A review of telephone company records of calls made to SJGC from the store manager's telephone shows that calls were made at 7:43 a.m. and 8:22 a.m. on November 14 and at 7:26 a.m. on November 20. Investigators are checking other telephones at the Humberto Vidal building to learn whether additional calls were made to the SJGC.

hole but did get a 25-percent gas reading in the second hole, which was in the intersection of the two streets, José de Diego and Camelia Soto. He told the brigade to make a third hole, and while it was being made, the explosion occurred.

Although combustible gas indications were found at three underground locations in front of the building on November 15 and 21, the leak testing done by SJGC employees on November 15, 20, and 21 was deficient in several ways. The tests were made at depths well above the gas mains and provided insignificant opportunity to identify locations to which propane gas vapors might have migrated underground. After finding indications of combustible gas in the subsurface, the brigade leaders did not instruct employees to make the bar holes to the depth of the gas main, which would have been necessary to allow testing adjacent to the gas main or testing to define the extent of gas in the subsurface. According to the leader of the third brigade, the bar holes made on November 20 were about the same distance north of the curb line as those his brigade had made, that is, about 5 to 6 feet. Additionally, the third brigade leader tested the bar holes that had been made on the previous day, even though any gas that might have been in the holes probably had already dissipated through venting. Even after the explosion, all three brigade leaders maintained that 18 inches was the correct depth to make bar holes for leak testing, regardless of the depth of the gas main.

The Safety Board's initial on-scene investigation indicated deficiencies in the training of SJGC employees. Several SJGC employees, including the three brigade leaders who responded to the leak complaints, had had on-the-job training (OJT) in surveying leaks and performing other assigned responsibilities. The brigade leaders received their leak survey training from an SJGC "trainer" who spoke both English and Spanish and who had been trained in the first quarter of 1996 by a leak survey consultant under contract to SJGC. In addition to the OJT from the consultant, the SJGC "trainer" received training materials, which advised that petroleum gases are heavier than air, that escaping vapors tend to settle in low places, and that vapors move along the bottom of ditch lines and substructures. The training materials also stated that when conducting tests for leakage from buried pipelines transporting petroleum gases, it is essential that samples be taken at or near the pipe, in the bottom of ditch lines, and at low points of substructures. When the SJGC "trainer" was able to demonstrate to the consultant his ability to perform leak detection testing, the SJGC "trainer" then trained other SJGC employees.

The Safety Board believes that the performance of the SJGC employees before the explosion and their statements afterward show that they have not been trained adequately in performing leak detection tests. Leak detection tasks require not only knowledge about the physical properties of propane gas, but also a certain skill level when using the combustible gas indicator to search for gas leaks. However, the Safety Board's initial review of the SJGC employee training process and training records and its interview of SJGC employees indicate that employee training tends to be knowledge-based rather than performance-based. Neither the knowledge attained as a result of SJGC leak detection training, nor the skill level, appear to be objectively measured and evaluated before personnel are cleared to perform this task without instructor supervision.

Also, SJGC's primary means of training its employees about its operating, maintenance, and emergency procedures is to instruct them to read the relevant documents, but the SJGC does not test its employees or evaluate their knowledge of the procedures. Other employee training is primarily OJT from brigade leaders or other more senior employees, and employees are not tested or comprehensively evaluated on this training. Consequently, the SJGC is unable to determine whether the training has accomplished its specific objectives and, when conducted by persons who speak a language different from that of the trainees, whether the translators accurately conveyed the information provided by the trainers.

Having one employee train another may be a practical solution when the only available training is in a language other than that spoken by most employees. Such training, however, is problematic. First, the employee functioning as "trainer" may not be familiar with the best ways to present information. Second, if the "trainer" is not fully proficient in the language used by the instructor, many opportunities for miscommunication and misunderstanding exist. Third, the "trainer," who has sometimes just been taught the information himself or herself, is not a qualified specialist and may only convey the information retained and his or her limited perspective on what was taught. Thus, he or she may not relay certain critical information to others.

The Safety Board believes that Enron needs to immediately retrain all SJGC employees who perform leak detection tests, *instructing them how to determine whether propane gas has leaked from the pipeline system, where and at what depth to test the subsurface, and how to define the likely extent of gas migration.* Enron should then expeditiously develop and provide--to all employees who perform gas system operations and safety-sensitive work tasks--training that imparts the knowledge needed to proficiently carry out all assigned responsibilities. The Safety Board believes it preferable that the retraining be done in Spanish by instructors who are technically experienced and knowledgeable about gas system operations to ensure that critical technical information is not lost in the translation process. Most important, the Safety Board believes that Enron should identify and implement an appropriate way of measuring the effectiveness of the training provided to each employee.

The Safety Board also reviewed SJGC's program for educating customers and members of the public about the danger of escaping propane gas and what actions to take in response. The program includes advertising in newspapers, distributing informational flyers, and making presentations to community groups. The flyers tell people to call the SJGC if they suspect a gas leak and, if the odor is "strong," to evacuate the area. However, the flyers do not tell people that *any* gas odor detected is potentially dangerous and, if they detect such an odor, what immediate action to take, other than calling the gas company, to protect their own safety and that of others. Of those people interviewed by the Safety Board, none were knowledgeable about the SJGC's public-information activities or recalled receiving any gas safety information from the SJGC. The Safety Board therefore concludes that the SJGC is not adequately educating the public about the hazards posed by gas leaks or about actions to take when the odor of gas is detected.

The Safety Board recently recommended that the Governor of Puerto Rico require that information be disseminated to educate members of the public about the potential hazards of

propane gas and about the actions they should immediately take to protect themselves and others when a gas odor is detected (Safety Recommendation P-96-26). On January 31, 1997, Puerto Rico's Secretary of State reported to the Safety Board that a subcommittee of concerned Puerto Rican agencies has approved proposals that "integrate the efforts of the public and private sectors to achieve an adequate level of education that will allow the citizens to face situations dealing with gas leaks." The Safety Board appreciates the Governor's prompt action and urges Enron to cooperate with the Governor in disseminating such information quickly. Additionally, the Safety Board believes that Enron must recognize its continuing responsibility under Federal regulations to educate the public so that people understand the dangers posed by a release of propane gas, can tell when such a release has occurred, and know when steps such as evacuating the area or notifying the local emergency-response agencies are appropriate. Enron needs to improve the SJGC's public education program and to develop a way of measuring the effectiveness of that program.

Safety Board investigators interviewed SJGC customer-service representatives and found that although the representatives query callers reporting a gas odor about the location and intensity of the odor, the representatives do not have a checklist of questions that should be asked to gather information adequate for assessing the potential degree of danger. Using such a checklist is one way to ensure that employees receiving calls obtain sufficient information so that customer-service representatives can give appropriate advice about remedial safety measures. Although the representatives use a list of safety tips, such as "do not turn on anything electrical," in advising callers about what to do until the SJGC arrives, they do not alert callers that they may need to evacuate a building in which the odor of gas has been detected. The representatives stated that they do not want to cause panic before the SJGC determines whether a leak has actually occurred. The representatives also do not decide whether local emergency-response agencies should be notified, a step that is necessary if the agencies are to have as much time as possible to take actions that may save lives.

The Safety Board concludes that the employees receiving calls are not collecting enough information to assess the degree of danger, advise the caller appropriately, or determine whether other entities should be notified. The Safety Board believes that Enron should require that the SJGC's procedures be modified so that an employee who receives a call about a gas odor will collect enough information to be able to assess the danger, advise the caller appropriately, and know whether to notify local emergency-response agencies.

Therefore, the National Transportation Safety Board recommends that Enron Corporation:

Immediately retrain all San Juan Gas Company employees who perform leak detection tasks, instructing them how to determine whether propane gas has leaked from the pipeline system, where and at what depth to test the subsurface, and how to define the likely extent of gas migration; in addition, implement a means of measuring the effectiveness of the training provided. (Urgent) (P-97-1)

Promptly develop and implement for San Juan Gas Company employees who perform operational and safety-sensitive responsibilities a training program that is

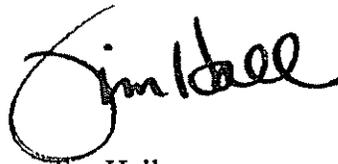
based on an evaluation of tasks assigned, so that it imparts the technical and procedural information needed to correctly perform their duties, and that incorporates a means of measuring the effectiveness of the training provided. (P-97-2)

Revise the San Juan Gas Company's public education program so that members of the public understand the danger posed by a release of propane gas, can tell when such a release has occurred, and know when steps such as evacuating the area or notifying the local emergency-response agencies are appropriate; incorporate in the program a means of measuring its effectiveness. (Urgent) (P-97-3)

Require the San Juan Gas Company to modify its procedures so that an employee who receives a call about a gas odor collects enough information to be able to assess the danger, advise the caller appropriately, and determine whether to notify local emergency-response agencies. (Urgent) (P-97-4)

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you regarding action taken or contemplated with respect to the recommendations in this letter. Please refer to Safety Recommendations P-97-1 through -4 in your reply. If you need additional information, you may call (202) 314-6462.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

A handwritten signature in black ink that reads "Jim Hall". The signature is written in a cursive style with a large, prominent "J" and "H".

By: Jim Hall
Chairman